NON-PUBLIC?: N
ACCESSION #: 9505010278
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Arkansas Nuclear One - Unit 1 PAGE: 1 OF 4

DOCKET NUMBER: 05000313

TITLE: Vendor Personnel Error in Programming an Upgraded Main Feedwater Pump Turbine Controller Resulted in a Manual Reactor Trip and Automatic Emergency Feedwater System Actuation
EVENT DATE: 04/03/95 LER #: 95-004-00 REPORT DATE: 04/26/95

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: N POWER LEVEL: 40

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: Thomas F. Scott, Nuclear Safety and Licensing Specialist TELEPHONE: (501) 858-4623

COMPONENT FAILURE DESCRIPTION:
CAUSE: A SYSTEM: JK COMPONENT: SC MANUFACTURER: L253
REPORTABLE NPRDS: Y

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

On April 3, 1995, Arkansas Nuclear One Unit 1 was operating at 40 percent power while conducting testing following a refueling outage. Operations personnel in the control room noticed a rapid reduction in speed indication for the operating Main Feedwater pump (MFP) and a corresponding reduction in feedwater flow rate. Since the other MFP was out of service, the reactor was manually tripped at 1733 hours. Nine seconds after the trip, an automatic actuation of the Emergency Feedwater (EFW) system occurred due to low water level in the Once Through Steam Generators (OTSGs). Plant response to the transient was normal. EFW pumps maintained OTSG water levels until the plant was stabilized at Hot Shutdown conditions. The root cause of the MFP speed reduction was determined to be a human error by vendor personnel who incorrectly

programmed a microcomputer as part of an upgrade to the MFP controls. The upgrade had been installed during the refueling outage. The programming errors were corrected and the MFPs performed without a recurrence of the problem during the subsequent power escalation testing.

END OF ABSTRACT

A. Plant Status

At the time of this event, Arkansas Nuclear One Unit 1 (ANO-1) was operating in steady-state conditions at approximately 40 percent power. Startup testing following a refueling outage was in progress. "A" Main Feedwater SJ! pump (WP) was in operation and "B" MFP was off line for startup testing and maintenance. The Integrated Control System (ICS) JA! was in automatic except for controls for "A" NWP that were in manual for ICS tuning. The Diverse Reactor Overpressure Protection System (DROPS)JC! was bypassed as allowed when reactor power is less than 45 percent.

B. Event Description

At Approximately 1733 hours on April 3, 1995, the reactor was manually tripped and automatic actuation of the Emergency Feedwater (EFW) BA! system occurred.

ANO-1 had completed a refueling outage on April 1, 1995. During this outage the controls for both MFPs were modified with an upgraded design. The "A" MFP had been in service performing satisfactorily since approximately 1420 hours on April 1. Between 1732 and 1733 hours on April 3, 1995, licensed control room Operations personnel observed a rapid reduction in speed indication for "N" MFP. The indication was confirmed by observing feedwater flow rates for both loops dropping and approaching zero. At the same time, personnel from the System Engineering and I&C Maintenance groups working locally at the "B" WP control system on the turbine deck observed the control oil pressure for "A" MFP rapidly reduce to a minimum value. Approximately fifteen seconds after the MFP speed decrease was noticed, the reactor was manually tripped. Nine seconds after the trip, EFW automatically actuated due to low water level in the Once Through Steam Generators (OTSGS) AB!. Plant response was normal. OTSG levels were satisfactorily maintained by the EFW pumps. Because of the initial power level and operation of the turbine bypass valves JI!, no Main Steam SB! safety valves lifted. All trippable control rod assemblies inserted with

acceptable insertion times. The "A' MFP continued to run at approximately 2000 rpm with no immediately apparent cause for the speed reduction. An automatic reactor trip from loss of all MFPs did not occur since "A" MFP did not trip. The drop in control oil pressure resulted in closing the governor valves but not tripping the turbine. The plant was in normal Hot Shutdown conditions with EFW pumps secured approximately 35 minutes following the reactor trip. After identification and correction of the cause of the event, the reactor was returned to critical at 2303 hours on April 4, 1995. The main generator was tied to the grid at 1342 hours on April 5, 1995.

C. Root Cause

The MFP turbine control runback was analyzed by personnel from Lovejoy Controls Corporation, the vendor supplying the upgraded controls, both on site and in their corporate office. It was noted that there had been no demand signal change or hydraulic problems that could account for the transient. The controller microcomputer was found to have a block of random access memory set to zero. This explained several indications with the WP controls noted during the transient. The program error was determined to have originated during a recent modification by the vendor that added an operator information touch screen module to the control system. ANO Computer Support personnel who were independently reviewing the controller computer code listings also discovered a logic error in a subroutine of the microcomputer. A mockup test confirmed that the combination of these errors resulted in a stuttered me
sage being received by
the controller that duplicated symptoms observed in the original event during several runs. The errors were corrected by re-programming the Erasable Programmable Read Only Memory (EPROM) units used by the controller microcomputers for both MFPS. The root cause for this condition is attributed to a human error on the part of vendor personnel who programmed the EPROMs containing the deficiencies.

D. Corrective Actions

Following installation of the modified EPROMs in both MFP controllers, they were satisfactorily tested and performed without a recurrence of the condition during the subsequent power escalation.

The MFP control system architecture and software were determined to

have no other application at ANO.

The vendor conducted a review of the computer codes to pre-empt any additional similar problem.

The affected software was determined to have satisfactorily completed vendor software verification and validation as well as multiple functional tests. The specific nature of the error made detection difficult without a long period of testing and burn-in. Because of the unique circumstances involved with the software error, additional corrective actions were not considered to be necessary.

E. Safety Significance

Neither the MFPs nor their controls provide any functions required to safely shut down the reactor, maintain the reactor in a safe shutdown condition, or mitigate the consequences of any analyzed accident. Plant response to the trip was as expected. The EFW system actuated as designed and satisfactorily maintained OTSG water levels. There were no significant post-trip complications or difficulties in establishing plant parameters within normal limits. Therefore, this event had minimal safety significance.

F. Basis for Reportability

Both the manual reactor trip and the automatic EFW actuation constitute actuation of an Engineered Safety Feature (ESF). This event was reported to the NRC Operations Center at 1847 hours on April 3, 1995, in accordance with 10CFR50.72(b)(2)(ii). This report is submitted in accordance with 10CFR50.73(a)(2)(iv).

G. Additional Information

There have been no previous similar events reported as Licensee Event Reports by ANO.

Energy Industry Identification System (EIIS) codes are identified in the text as XX!.

Russellville, AR 72801
Tel 501 858-5000

April 26, 1995

1CAN049502

U. S. Nuclear Regulatory Commission
Document Control Desk
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Washington, DC 20555

Subject: Arkansas Nuclear One - Unit 1
Docket No. 50-313
License No. DPR-51
Licensee Event Report 50-3 13/95-004-00

Gentlemen:

In accordance with 10CFR50.73(a)(2)(iv), enclosed is the subject report concerning a manual reactor trip and automatic actuation of the Emergency Feedwater system.

Very truly yours,

Dwight C. Mims
Director, Licensing

DCM/tfs

enclosure

cc: Mr. Leonard J. Callan
Regional Administrator
U. S. Nuclear Regulatory Commission
Region IV
611 Ryan Plaza Drive, Suite 400
Arlington, TX 76011-8064

Institute of Nuclear Power Operations

700 Galleria Parkway
Atlanta, GA 30339-5957

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